REMARKS/ARGUMENTS

The Status of the Claims.

Claims 19 to 42 and 68 are pending with entry of this amendment, claims 1 to 18 and 43 to 67 being cancelled and claim 68 being added herein. Claims 19 and 37 are amended herein. These amendments introduce no new matter and support is replete throughout the specification. These amendments are made without prejudice and are not to be construed as abandonment of the previously claimed subject matter or agreement with any objection or rejection of record.

With respect to claim 19, support for cross-linking and polymerization can be found throughout the specification. For example, see specification at paragraphs 10, 21, 45, 65, and 70; Figures 2 and 3.

With regard to claim 33, the amendment merely adjusts antecedence to reflect the amendment to the parent claim.

With regard to new claim 68, the support for alignment ligands cross-linking matrix nanostructures can be found throughout the specification and Figures.

Applicants submit that no new matter has been added to the application by way of the above Amendment. Accordingly, entry of the Amendment is respectfully requested.

35 U.S.C. §112, Second Paragraph.

Claims 19 to 37 were rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite because the Office alleged "[t]here is too much structure and order recited for the material to be considered a 'composition' per se." Applicants traverse the rejection.

Apparently the rejection is based on the allegation that compositions intrinsically can not be ordered or structured. Applicants disagree and do not take Official Notice of the rationale and conclusion in the rejection. Applicants note that, according to MPEP 2144.03, it is the burden of the Office to provide documentary evidence supporting the conclusions upon which a rejection is based.

Applicants note that a composition is, e.g., a product of mixing or combining various elements or ingredients (Webster's). Compositions are "composed" - to arrange in proper or orderly form (Webster's). Even in common usage, compositions can be structures arranged in order. Compositions of matter do not have to be simple unstructured amorphous liquids. See evidence in the abundant semiconductor compositions and plastic compositions rightly patented at the Office.

Because the structurally ordered moieties comprising ordered nanostructures are unambiguously compositions of matter, and proper subject matter of patents (see, 35 U.S.C. §101), Applicants respectfully request withdrawal of the rejections for alleged indefiniteness.

35 U.S.C. §112, First Paragraph.

Claims 19 to 39 and 42 were rejected under 35 U.S.C. §112, first paragraph, as allegedly lacking enablement. To the extent the currently amended claims are deemed to lack enablement, Applicants traverse.

To be an enabling disclosure under § 112, first paragraph, a patent must contain a description that enables one skilled in the art to make and use the claimed invention. That some experimentation is necessary does not constitute a lack of enablement; the amount of experimentation, however, must not be unduly extensive. See *In re Wands*, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988). Whether undue experimentation is required by one skilled in the art is typically determined by reference to eight factors considered relevant to the inquiry: (1) quantity of experimentation necessary; (2) amount of guidance presented; (3) presence of working examples; (4) nature of the invention; (5) state of the prior art; (6) relative skill of those in the art; (7) predictability of the art; and (8) breadth of the claims. *See id.*

The Office has objected to the claims "open to ligands generically that 'interact' to 'thereby structurally ordering the plurality of nanostructures'." The rejections were based on allegations that this phrase lacks working examples, lacks adequate guidance and would be unpredictable. However, Applicants have amended the claims to remove the objected term and to focus on highly enabled embodiments.

The quantity of experimentation to practice species throughout the scope of the claimed invention would be reasonable. Given the maturity of polymer science, as discussed below, and the guidance in the specification and incorporated references, one of skill could easily practice embodiments, as claimed. For example, one of skill could readily employ the structures of Figure 3, binding a nanostructure to the "head" group and cross linking the molecules according to standard chemistries to provide a polymer with aligned nanostructures. Other species could be practiced by employing other chemistries discussed in the specification and incorporated by reference, as discussed below.

The amount of guidance provided is substantial and exhaustive. A patent need not teach, and preferably omits, what is well known in the art. *In re Buchner*, 929 F.2d 660, 661, 18 USPQ2d 1331, 1332 (Fed. Cir. 1991); *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1384, 231 USPQ 81, 94 (Fed. Cir. 1986), cert. denied, 480 U.S. 947 (1987); and *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1463, 221 USPQ 481, 489 (Fed. Cir. 1984). Here, Applicants teach more than is necessary in the specification, and further directs one to references providing guidance to methods and materials to practice the invention in full scope.

The general concept of structurally-ordered nanostructures in a matrix is discussed throughout the specification. Specific examples of ligand components for ordering the nanocrystals is found in Figure 3 and in the section entitled Methods of Preparing a Nanostructure-Matrix Composition. For example, the specification discloses standard protocols for preparation of matrices can be found, for example, in Nalwa (2001) Advanced Functional Molecules and Polymers volumes 1-4; Kroschwitz et al., (1990) Concise Encyclopedia of Polymer Science and Engineering (Wiley-Interscience, New York, NY); Chandrasekhar (1999) Conducting Polymers, Fundamentals and Applications: A Practical Approach (Academic Publishers, Boston, MA, 1999); and Brandrup (1999) Polymer Handbook, 4th Edition (John Wiley & Sons, Ltd, New York, NY), which references are incorporated herein in their entirety.

Any of a number of matrix compositions known in the art can be employed in the compositions and methods of the present invention. For example, a wide variety of nanostructure-compatible polymers are known to those of skill in the art (see e.g., Demus et

al. (ed.) 1998 Handbook of Liquid Crystals Volumes 1-4 (John Wiley and Sons, Inc., Hoboken, NJ); Brandrup (ed.) 1999 Polymer Handbook, (John Wiley and Sons, Inc.) ; Harper 2002 Handbook of Plastics, Elastomers, and Composites, 4th edition (McGraw-Hill, Columbus, OH); and Kraft et al. (1998) Angew. Chem. Int. Ed. 37:402-428.

Exemplary polymers for use in the present invention are described, such as thermoplastic polymers (e.g., polyolefins, polyesters, polysilicones, polyacrylonitrile resins, polystyrene resins, polyvinyl chloride, polyvinylidene chloride, polyvinyl acetate, or fluoroplastics); thermosetting polymers (e.g., phenolic resins, urea resins, melamine resins, epoxy resins, polyurethane resins); engineering plastics (e.g., polyamides, polyacrylate resins, polyketones, polyimides, polysulfones, polycarbonates, polyacetals); and liquid crystal polymers, including main chain liquid crystal polymers (e.g., poly(hydroxynapthoic acid)) and side chain liquid crystal polymers (e.g., poly [n-((4'(4"-cyanphenyl)phenoxy) alkyl)vinyl ether]). Certain embodiments can include conductive organic polymers; see e.g. T. A. Skatherin (ed.) 1986 Handbook of Conducting Polymers I. (Marcel Dekker, New York). Examples of conductive polymers for use as matrices of the present invention include, but are not limited to, poly(3-hexylthiophene) (P3HT), poly[2-methoxy, 5-(2'-ethyl-hexyloxy)-p-phenylene-vinylene] (MEH-PPV), poly(p-phenylene vinylene) (PPV), and polyaniline.

The specification points to sister application USSN 60/452,232 and Attorney Docket No. 40-002710US, compositions that can also be used as matrix components of the present invention. For example, see paragraph 130 regarding introduction of nanostructures to matrix components.

Paragraphs 75 to 78 discusses cross-linking in general, provides abundant examples of specific cross-linking agents and provides reference to further useful publications.

Paragraph 18 identifies Huang et al. (2003) "From 1D chain to 3D network: Tuning hybrid II-VI nanostructures and their optical properties" J. Am. Chem. Soc. 125:7049-7055), which teaches how to prepare 2D and 3D matrices of polymerized components comprising nanostructures.

The amount of guidance provided in support of the claims provided in the specification foes beyond the *Wands* standard. The guidance is commensurate to the scope to the amended claims.

The relative skill in the art is high. As in *Wands*, "all of the methods needed to practice the invention were well known." 858 F.2d at 740, 8 USPQ2d at 1406. The skill in the art of chemical and biological polymerizations is very high. This is evidenced by the scope of the incorporated references. At the time of *Wands*, the skill in monoclonal antibody art was relatively low compared to the polymer skill at the time of filing the present specification.

The predictability of the art is reasonable in light of the claims. The success rate in the Huang, JACS article was quite high in providing matrices incorporating nanostructures over a broad scope of embodiments. The maturity of the polymerizations arts allows one to practice the scope of invention with a reasonable degree of confidence.

The breadth of the claims, is reasonably focused in the enabling support. The general and objected term "interacts" has been deleted. As amended, the claims focus on the cross-linking and polymerization aspects that are broadly supported by the original specification and incorporated references and general knowledge in the art.

Because the currently amended claims are specifically and generally supported with enabling disclosures and general knowledge, the claims could be practiced without undue experimentation. Applicants respectfully request withdrawal of the rejections for under section 112.

35 U.S.C. §102.

Claims 19 to 21, 23 to 27 and 30 to 35 were rejected under 35 U.S.C. §102(b) as allegedly anticipated by Colvin, et al., JACS 114: 5221-5230, 1992. To the extent the rejection is deemed applicable to the amended claims, Applicants traverse.

In order for a reference to anticipate an invention, the reference must teach each and every element of the claimed invention. That is, in order for a reference to anticipate an invention, "all limitations of the claim are found in the reference, or 'fully met' by it." *Kalman v. Kimberly-Clark Corp.*, 218 USPQ 781, 789 (Fed. Cir. 1983).

The rejection is based on the assertion that "in Figure 1 two different ligands attached to the CdS nanocrystals. The two ligands are S(CH2)2COO and S~COOH; the examiner takes the position that these ligands will function as claimed. Additionally, adjacent S~COOH ligands on the surface of two adjacent CdS particles interact with each other , the examiner takes the position that this would aid in 'ordering the plurality of nanostructures' as claimed." Official Notice is not taken of the conclusory positions in the rejection, thus obligating the Office to provide reasonable documentary evidence supporting the conclusions upon which the rejections are based.

Contrary to the stated basis of the rejection, 1) the ligands of cited Figure 1B are not different ligands, 2) the ligands of a first nanostructure do not interact with the ligands of a second nanostructure, and 3) an interaction between ligands of different nanostructures does not thereby structurally order the nanostructures. Further, with regard to the amendments to the claims, the "ligands" of Colvin do not cross-link between nanostructures and do not thereby form a polymerized matrix of ordered nanostructures.

Looking at the actual facts of the specifically cited teachings, one finds an entirely different composition from the claimed inventions. Colvin uniformly disperses nanostructures on a metal surface using self-assembled monolayers as a bridge (page 5222, column 1) to tailor the distance between the nanostructure and the metal. In the cited Figure 1B, the nanostructures are first coated with the bridging group thioglycolic acid in suspension, then they are attached to the metal surface (page 5222, column 2). Note that the nanostructures have the same relationship in Figures 1A, B and C regardless of the presence of a full bridge group coating (thus, the cited ligands do not appear to influence the nanostructure order). Colvin employs short bridge chains in cited Figure 1B specifically to avoid interactions between bridge groups and resulting in "a quite disordered" distribution of the nanostructures on the surface (page 5229, column 1). The bridging groups are specifically designed to interact between the nanostructure and metal surface and to avoid interaction with each other.

Furthermore, Colvin specifically teaches away from interactions, such as cross-linking, between ligands. No polymerization takes place in Colvin.

Because Colvin does not teach all limitations of the independent claim 19, it can not be considered anticipated, nor can any dependent claim.

Further with regard to dependent claims, the Office has made almost no attempt to state a case alleging anticipation based on facts. Applicants note that Colvin does not teach, e.g., oriented nanostructures, aligned nanostructures, alignment molecules that are different molecules, alignment molecules that are complementary binding pairs, binding pairs that have selective molecular recognition functionality, two or more selective molecular recognition functionalities, or interactions between ligands, as required in the nominally rejected dependent claims.

Because Colvin does not teach all the limitations of any claim, Applicants respectfully request withdrawal of the rejections for alleged anticipation.

35 U.S.C. §103(a).

Claims 37 to 39 and 42 were rejected under 35 U.S.C. §103(a) as allegedly obvious based on Lieber (U.S. 7,2211,464) in light of ordinary skill in the art. To the extent the rejection is deemed applicable to the amended claims, Applicants traverse.

A proper analysis under the recently reaffirmed *Graham v John Deere* standard demonstrates the non-obviousness of the invention. According to the Supreme Court in *KSR International Co v. Teleflex* (550 U.S. ____ (2007); 127 S. Ct. 1727, 1740-41, 82 USPQ2d 1385-1396 (US 2007)), the appropriate standard for analyzing questions of obviousness is that:

> the scope and content of the prior art are determined, differences between the prior art and the claims at issue are analyzed and the level of ordinary skill in the pertinent art is resolved. Against this background the obviousness or non-obviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unresolved needs, failure of others, etc. might be utilized to give light to the circumstances surrounding the origin of the subject matter to be patented.
>
> *Id.* quoting *Graham v. John Deere of Kansas City* 383 U.S. 1, 17-18.

The current Examination Guidelines (e.g., MPEP 2143) and *KSR* require the Office in an obviousness rejection to provide a statement as to why one of skill would have combined known elements. Further, an obviousness rejection must include fact-based

findings demonstrating: 1) a combination of reference elements describing each limitation of the claims, 2) known elements that function in the same way in the combination as in the references themselves, 3) the elements are combined by known methods, 4) the result of the suggested combination of elements would have been predictable, and 5) one of skill in the art would have expected success in providing the claim in light of the references. Here, the rejection fails each of these requirements, as applied to the *Graham* factors.

Lieber appears to teach elongated nanostructures aligned on a surface. At column 17, line 45, a method for aligning nanostructures includes "dispersing the one or more elongated structures in a flexible matrix; stretching the flexible matrix in a direction to produce a shear force on the one or more elongated structures that causes the at least one elongated structure to align in the direction; removing the flexible matrix; and transferring the at least one aligned elongated structure to a surface." Emphasis added. The present rejections are based on the statement that "[i]t would have been obvious to one of ordinary skill in the art to maintain the nanostructure clusters in the matrix in order to keep the nanostructure cluster aligned on the surface of the substrate since the matrix can be stretched magnetically to the surface of the substrate."

Official Notice is not taken of the unsupported statement in the rejection. Further, the conclusory statement fails in it's logic, fails to combine elements with known function according to known methods, does not suggest why one of skill would be prompted to make the suggested combination, and would not have been expected to succeed.

Stretching a matrix of randomly oriented nanowires can tend to orient the wires somewhat along the direction of the stretching. Lieber then removes the matrix, e.g., so the free wires can be deposited to make certain desired electronic contacts. The matrix is removed to avoid interference with contact formation and circuit function. Contrary to the rejection, it would not be obvious to maintain the matrix in order to keep the nanostructures aligned. It is clear for reading the only discussion of matrices in Lieber (column 17, line 45) that the whole intent of the matrix stretching is to obtain an alignment that is stable after the matrix is removed. Aligned nanostructures of Lieber are freed of the matrix and do not need to be "kept aligned" by the matrix. Therefore, the rationale for the rejection fails and the rejection must be withdrawn.

Further, it is not obvious to retain nanostructures in a matrix on the surface, as stated in the rejection "since the matrix can be stretched magnetically to the surface of the substrate." It is not logical that it would be obvious to maintain the nanostructures aligned in the matrix on a surface, just because it can be done (if it can be). In *KSR*, the Court found one of skill would be prompted to solve a stated problem by combining art. "[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the art to combine the elements as the new invention does." In Lieber, there is no problem to be solved by the suggested retention of matrix, so one of skill would not be prompted to take the suggested actions. That is, removal of the matrix provides nanowires that do not need to be kept aligned. In fact, one of skill would be prompted not to act as suggested in the rejection because retention of the matrix causes problems in the context of Lieber.

The allegations in the rejection fail to describe how elements of known function could have obviously been combined according to known methods, as required by *KSR* and the Office's own guidelines. The known function of the Lieber matrix is to stretch embedded nanowires into alignment on application of a force. This is not the known function of the matrix in the present claims. Further, the concept of magnetically stretching the matrix on the surface of a substrate is drawn out of thin air, without any support. In fact, it is clear that a matrix can not stretch while attached to a solid matrix. Because the suggested combination of concepts does not employ elements according to known function using known methods, the combination does not render the claims obvious.

The suggested combination of elements would have failed to provide the claimed invention. As noted above, the combination would not have combined known elements according to known methods, so would have been unpredictable. Further, since Lieber describes the matrix only as "flexible", one would not know what to expect with regard to maintenance of the stretched configuration, interaction with the substrate or maintenance of the nanowire orientation in the matrix, e.g., during the unknown processing steps directed to producing products of unknown utility.

With regard to dependent claims, the Office does not appear to provide any fact-based rationale for the rejections. Applicants note that Lieber does not discuss

selectively-oriented nanostructures, e.g., aligned by interactions of alignment ligands between the nanostructures, as described in the present specification.

Because Lieber is structurally and functionally different from the claims, and one of skill would not have attempted or expected success in the suggested modifications without impermissible hindsight, the claims are not obvious. Applicants respectfully request withdrawal of the rejections.

CONCLUSION

In view of the foregoing, Applicants believes all claims now pending in this application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the claims are deemed not to be in condition for allowance after consideration of this Response, a telephone interview with the Examiner is hereby requested. Please telephone the undersigned at (510) 769-3510 to schedule an interview.

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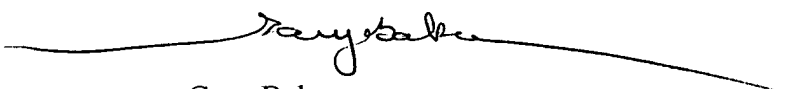
Respectfully submitted,



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Attachments:

1) A transmittal sheet; and,
2) A receipt indication postcard.